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Protocol Papers

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Protocol Papers

Obstructive sleep apnea diagnosis and management in First Nations communities: protocol for the Let's Yarn About Sleep-Obstructive Sleep Apnea Program

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Abstract

Obstructive Sleep Apnea (OSA) is a highly prevalent, yet significantly under-recognized disorder in First Nations Australians. Responding to strong community demand for local capacity building for sleep health equity, this paper outlines the Let's Yarn About Sleep-OSA (LYAS-OSA) program protocol. The LYAS-OSA program will involve the co-design, implementation, and evaluation of a place-based, culturally responsive, nurse-led, and Aboriginal Health Worker-supported model for OSA diagnosis and management for First Nations peoples. This program will partner with health services and organizations across 12 communities in Queensland, Australia. The program will be conducted from 2023 to 2027. During the set up and development stage, an advanced data analytics study of secondary data will examine OSA phenotypes and symptomatology in First Nations Queensland communities. In addition, consumers and healthcare professionals will be engaged in co-design workshops to inform the development of a service delivery model framework. In stage two, local capacity building activities for Aboriginal Health Workers and nurses will be undertaken, with training on OSA diagnosis and management. This work will culminate in delivering and evaluating the co-designed service model. This community-led approach to co-designing, implementing, and evaluating the LYAS-OSA service delivery model will advance knowledge to deliver culturally responsive, context-responsive, OSA diagnosis, and management care for First Nations communities. The LYAS-OSA program outputs will significantly contribute to the evidence base and service delivery provision for OSA care, thereby improving sleep health equity for First Nations Australians.

Key words: First Nations; indigenous; sleep; Obstructive Sleep Apnea; co-design; culturally responsive healthcare

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Statement of Significance

Obstructive Sleep Apnea (OSA) in First Nations communities is highly prevalent, yet limited community awareness, lack of culturally responsive services, and unavailability of local diagnosis and management hinder timely and effective care. Addressing these gaps is crucial for improving sleep health equity for First Nations Australians. The program offers a community-led, co-designed, place-based model of care that integrates data analytics, co-design, and healthcare providers' capacity building to address service delivery gaps. This approach aims to bridge service delivery gaps in Obstructive Sleep Apnea care for First Nations peoples across Australia. The outputs and outcomes from this program will significantly contribute to the evidence base for improving the quality and accessibility of Obstructive Sleep Apnea care for First Nations Australians.

Introduction

Obstructive Sleep Apnea (OSA) is a common respiratory disorder characterized by repetitive periods of airway obstruction during sleep. Repeated partial or complete collapse of the upper airway deprives the lungs of oxygen, resulting in a wide array of consequences, including sleep fragmentation, excessive daytime sleepiness, cardiovascular disease, neuro-cognitive impairments, metabolic dysfunction, poor mental health, reduced productivity, and increased risk of motor vehicle accidents [1, 2].

The estimated prevalence of moderate–severe OSA is relatively high among Aboriginal and Torres Strait Islander peoples (henceforth referred to as First Nations Australians) in both community (25 per cent) and clinical settings (50 per cent) [2, 3]. This high prevalence may be partly due to increased rates of obesity and chronic health conditions among First Nations peoples in Australia. Despite this, OSA remains under-recognized and under-researched [4], highlighting the need for increased awareness and culturally responsive approaches to service delivery. The potentially profound human, societal, and economic costs of OSA to First Nations Australians therefore necessitates prioritizing research in this area [1, 5].

In Australian sleep healthcare settings, the current publicly funded OSA diagnosis and management model relies on specialist pathways involving laboratory-based polysomnography (PSG) and respiratory clinics, which present a range of barriers for First Nations Australians, particularly in non-metropolitan areas [6, 7]. In non-metropolitan areas, the scarcity of laboratory facilities, which are costly to establish and need clinical and technical expertise, along with limited access to specialist providers, often results in long waits and missed opportunities for OSA diagnosis and treatment [6, 8]. As such, the existing OSA diagnosis and management model in Australia presents significant challenges for First Nations peoples, likely contributing to sleep health disparities.

The existing OSA service model needs reform to become culturally and contextually responsive and reduce external dependency on metropolitan and major regional sleep centers. There is strong evidence of the effectiveness of OSA diagnosis and management through primary care [9, 10]; however, inadequately trained staff, limited knowledge and resources to offer culturally responsive care, and service fragmentation limit service uptake among First Nations peoples [8]. Models that incorporate home sleep studies and nurse-led OSA services are emerging as acceptable and cost-efficient alternatives to specialist pathways that can be adapted to First Nations communities [9]. Ensuring the cultural responsiveness of these services, however, is critical for community acceptance of OSA diagnosis and management in First Nations communities [10]. It is well established that First Nations leadership and capability building are integral for offering culturally responsive services [8–10]. Therefore, co-design, community empowerment, and local capacity building offer potential solutions for effective OSA service delivery in First Nations communities.

Let's Yarn About Sleep

The Let's Yarn About Sleep (LYAS) program [11] is a community-based sleep health improvement program for First Nations peoples in the remote community of Mount Isa (Queensland, Australia). The LYAS program was co-created with community members and service providers to help improve sleep health and mental health outcomes for community members. The goal of the program was to train and upskill Aboriginal Youth Workers to deliver the co-designed tools, resources, and sleep health improvement program. Since its inception, the LYAS program has expanded to other communities across Queensland and the Northern Territory. Extensive consultation with key local stakeholders identified the need for community-based services for OSA diagnosis and management. Aligned with the Australian Government's National Aboriginal and Torres Strait Islander Health Plan 2021-31 [12], this extension of the LYAS program, LYAS-OSA, is an interdisciplinary, translational program, centered on community empowerment, co-design, local capacity building, and place-based delivery to deliver culturally responsive OSA care across 12 regional, rural, and remote First Nations communities in Queensland, Australia.

This research program will address an important area of unmet need—specifically, the under diagnosis and inadequate treatment and management of OSA in First Nations communities in non-metropolitan regions, contributed to by a lack of resources and training to deliver culturally responsive OSA care [13].

Program objectives

The primary objective of this research program is to trial and evaluate a co-designed service model that will enable local delivery of culturally responsive OSA care in First Nations communities. To enable this, a series of interconnected work packages (WPs) will be undertaken, with the following aims:

Aims

1) Understand the clinical profile of First Nations patients presenting with OSA.
2) Explore community needs and challenges in receiving OSA care and co-design an OSA service model with resources that meet community needs and expectations.
3) Understand service providers' challenges in offering culturally responsive OSA care and co-design resources to support clinicians in providing OSA care to First Nations peoples.
4) Offer OSA diagnosis and management training to AHWs and nurses to strengthen their capacity and capability for delivering OSA care to First Nations peoples.
5) Implement and evaluate a nurse-led and AHW-supported OSA diagnosis and management model through two service delivery sites in Queensland.

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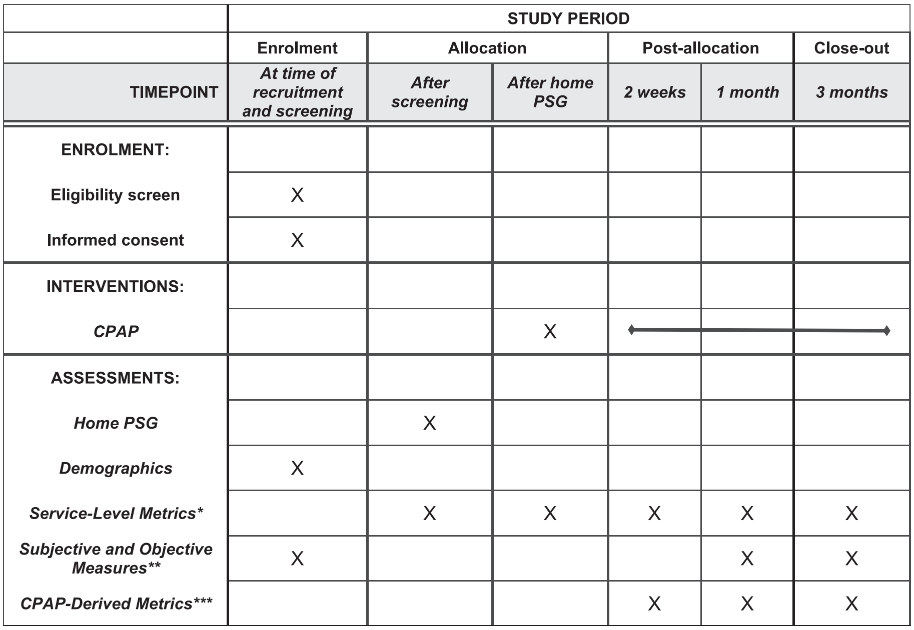

	STUDY PERIOD					
	Enrolment	Allocation		Post-allocation		Close-out
TIMEPOINT	*At time of recruitment and screening*	*After screening*	*After home PSG*	*2 weeks*	*1 month*	*3 months*
ENROLMENT:						
Eligibility screen	X					
Informed consent	X					
INTERVENTIONS:						
CPAP			X	←	—	→
ASSESSMENTS:						
Home PSG		X				
Demographics	X					
Service-Level Metrics*		X	X	X	X	X
Subjective and Objective Measures*	X				X	X
CPAP-Derived Metrics**				X	X	X

Figure 1. Project timeline. ∗Time (days) from screening to home PSG, time (days) from positive home PSG to commencing CPAP, number of clinical points of care. ∗∗Functional Outcomes of Sleep Questionnaire Short Form, Epworth sleepiness scale, short form 36, EQ-5D-5L, Insomnia Severity Index, OSA-50, general practice sleep scale, height, weight, systemic blood pressure. ∗∗∗Days used >4 h, days used, apnea–hypopnea index, 95 percentile and median pressure (cmH2O), 95 percentile and median leak (L/min). Abbreviations: CPAP: continuous positive airway pressure, PSG: polysomnography.

Materials and Methods

Design

The research program comprises five interconnected WPs to examine OSA endo/phenotypes, undertake a prospective consultation and engagement approach to understand community and health practitioner needs in OSA care, upskill the local workforce, and deliver and evaluate an AHW and nurse-led model of OSA care. The project timeline is outlined in Figure 1.

Project governance

An important design feature of the LYAS-OSA program is effective governance. At the research program's beginning, a governance structure will be established. The structure includes a Community Members' Steering Committee, an Indigenous Data Governance Committee, the Service Providers' Advisory Group, a Knowledge Mobilization Group, the Research Team, and the Service Delivery Team. The research team includes First Nations researchers and cultural mentors who support non-First Nations researchers in developing their cultural capabilities.

The Community Members' Steering Committee will include First Nations community members from participating communities. The committee will oversee the program and ensure First Nations' paradigms, worldviews, and current and historical contexts guide its design and delivery.

The Service Providers' Advisory Group will include First Nations and non-First Nations sleep health clinicians and operational and administrative staff from primary care services. It will provide strategic direction and expert advice on WP design, implementation, and evaluation. It will also advise on recruitment, data collection, and interpretation of findings.

A First Nations Data Governance committee will also be established to ensure community ownership and management of research data. The committee will advise and guide the team on strengths-based reporting and review, provide feedback, and approve all project outputs.

The knowledge mobilization group will engage a broad range of policy, advocacy, and practice stakeholders to maximize the reach of the project's findings. The group will include sleep health advocacy and service delivery organization members to strengthen advocacy activities and develop pathways for creating/enhancing research impact at the consumer, policy, and practice levels.

Program guiding framework

The LYAS-OSA program is based on the Nukal Murra (Plenty Hands) social and emotional well-being (SEWB) framework [14], which is a strengths-based focus on improving First Nations communities' health outcomes in non-metropolitan Queensland. The framework is based on the declaration of Gayaa Dhuwi (Proud Spirit) [15] and it recognizes First Nations peoples' cultural strength, including their connection to country and culture, spirituality, ancestral ties, resilience, kinship, community leadership, and governance [15]. Specifically, this framework seeks to place "the person, family, and community at the center of the solution and acknowledge the clients' and the communities' resilience and strengths as a vital asset" [15]. The *Collective Benefit, Authority to Control, Responsibility, and Ethics* Principles for Indigenous Data Governance [15] will be adhered to at all times, alongside NHMRC Ethical guidelines for Indigenous Health Research [16].

Stage 1—set up and development stage (Work Package 1-3).

WORK PACKAGE 1: DATA HARMONIZATION AND ANALYTICS TO STUDY OSA PHENOTYPES, ENDOTYPES, AND SYMPTOMATOLOGY.

Background OSA can be categorized into subtypes based on variations in presenting pathophysiological patterns of disease observed on the polysomnogram (OSA severity phenotypes), underlying pathophysiological mechanisms (endotypes), and symptomatology (OSA symptomatology phenotypes) [17].

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Increasingly, research has focused on understanding the variations in symptom clusters, PSG phenotypes, and physiological endotypes in OSA [18]. More research is needed on OSA in First Nations peoples in Australia to identify whether there are characteristic presentations of OSA phenotypes, endotypes, and symptomatology for First Nations populations. Understanding these factors in First Nations peoples may help identify relevant OSA subgroups to provide a foundation to develop strategies for more targeted diagnostic and management decisions, which may improve treatment response and adherence. The WP will describe OSA severity phenotypes, the underlying pathophysiological endotypes, and the OSA symptomatology phenotypes in First Nations Australian adults who have previously completed overnight clinical PSG.

Methodological approach This WP will involve a secondary analysis of de-identified polysomnographic data collected from routine sleep studies of First Nations Australian patients at two Queensland Hospitals and Health Services (HHSs). This WP aims to develop high-quality, new evidence by describing the features of OSA among First Nations Australian adults using routinely collected PSG and other non-identifiable clinical data from two HHSs. These advanced analyses will provide a detailed understanding of the OSA symptoms, clinical presentations, and underlying pathophysiological attributes of OSA in First Nations Australians. The findings from these analyses will provide new, valuable information enabling evidence-based care, and facilitating the integration of precision medicine in OSA care for First Nations peoples.

Participants Adult Aboriginal and Torres Strait Islanders referred to the sleep and respiratory clinics at the two HHSs for a sleep study between 2015 and 2022 will be included. The inclusion criteria will be: (1) adults aged ≥18 years; (2) identifying as Aboriginal and/or Torres Strait Islander; and (3) have completed overnight PSG recorded at the relevant health service.

Measures PSG data collected either in a laboratory or in-home using devices, manufactured by Compumedics that are approved by the Therapeutic Goods Administration in Australia for recording PSG data. The clinical reports will include a summary of sleep study-derived psychophysiological metrics, including sleep staging, architecture, cortical arousals, and cardiorespiratory metrics, including nasal pressure and flow, pulse oximetry, and respiratory effort and their respective indices, such as the Apnea-Hypopnea Index and arousal index. Additional routinely collected information will be utilized, including demographics (e.g. age, gender identity, body mass index, BMI [or height and weight]), and significant comorbidities. Information on symptomatology will be obtained from self-reported data on snoring, witnessed apneas and sleepiness, as well as responses to the Epworth Sleepiness Scale (ESS), OSA screening questionnaires (STOP-BANG and OSA-50 for selected sleep studies), and therapy compliance will also be utilized (where available).

Data analysis This project will extract data from ∼300 sleep studies conducted at two study sites. Advanced biomedical signal processing techniques will be employed to generate new insights into OSA pathophysiology amongst First Nations Australian adults. We will apply previously validated algorithms to the data to determine: (1) The OSA severity phenotypes presentation including hypoxic burden, arousal burden, flow limitation, and disruption of sleep architecture; (2) endotype characteristics, such as anatomical attributes, pharyngeal dilator muscle function, ventilatory control, and arousal threshold [19–24]; and (3) OSA symptomatology phenotypes such as sleepiness, and where available, clinical notes and treatment responses will be analyzed to provide insights into treatment efficacy and improvements in OSA-related pathophysiology. These insights will build a foundation to develop models of care, which offer patient-centered, tailored care, and guide future clinical and research activities.

Work package 2: Co-design of culturally responsive and context-responsive OSA care with consumers and community members.

Background Our pilot work, evidence from other research, and the landmark 2019 Federal Government Sleep Health Inquiry [25]. This WP will highlight the need to understand community challenges in accessing sleep health care and embed end-user input in designing service models and sleep health resources. Responding to community needs, this WP aims to understand how OSA service delivery can be improved to meet community needs. It will co-design the OSA service delivery model and evaluation framework with and for First Nations peoples in rural, remote, and regional communities. The co-design approach will ensure that community voices and leadership are embedded in service design, facilitating community acceptance and uptake of the service.

Participants Participants will be drawn from remote Northwest and Far North Queensland communities. In each community, 25–30 community members, consumers (people with OSA), and carers will be invited to join co-design workshops. The Inclusion criteria for workshop participation are age ≥ 18 years, identifying as a First Nations person, and experiencing/knowing someone with any of the following symptoms:

- Loud snoring
- Pauses in breathing while sleeping
- Waking up gasping or choking
- Awakening with a dry mouth
- Excessive daytime sleepiness

Methodological approach The co-design process will be based on community-based participatory research and knowledge co-creation [26]. Consumers and community members will participate in four face-to-face co-design workshops over 24 weeks (up to 60 min each). These workshops are designed to:

- Understand the challenges experienced by community members in accessing culturally responsive OSA care.
- In partnership with community members, generate an evidence-based, co-designed OSA service delivery model, resources, and factsheets.
- Co-develop an evaluation framework and tools to assess the effectiveness and cultural responsiveness of the service delivery model.

The co-design workshops will be conducted in the following three phases: Learning (workshops 1 and 2), Designing (workshop 3), and Refining (workshop 4). The learning phase will include interactive and creative methods, i.e. context/empathy mapping, patient journey mapping, and persona creation to empathize with the challenges and context of consumers and understand their needs (e.g. what does good sleep mean to you? What would an ideal sleep health service look like?) [7, 27–29]. The learning phase will incorporate interactive and creative methods based on

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participant needs, including empathy mapping and the Tree of Life activity, to deeply understand the challenges, contexts, critical touchpoints, and experiences of individuals engaging with the program and their journey in seeking OSA care [27]. The design phase will include brainstorming sessions to ideate pragmatic, actionable, sustainable solutions, co-develop prototypes of community awareness and educational resources and tools to support culturally responsive OSA care, and identify evaluation indicators to assess the effectiveness of co-designed prototypes. The last phase—refining—will elicit participants' feedback to refine the program, resources, and evaluation tools. This iterative process ensures that the co-design approach is grounded in community perspectives and that the co-design outputs meet community needs. Written informed consent will be taken from all participants to take part in this study by the community researchers.

Data analysis Descriptive statistics will summarize the demographic information of the co-design workshop participants. Based on Braun and Clarke's six-step framework (28), a reflexive, inductive thematic analysis approach will be utilized for qualitative data analysis to elicit meaning, understand, and develop empirical knowledge. First Nations researchers on the team will help analyze and interpret the findings through a lens of cultural competence and ensure that data reporting is based on a strengths-based approach rooted in holistic data synthesis [15, 30]. The findings from the co-design workshops will be shared during community roadshows in accessible and culturally appropriate formats. These may include plain language summaries, visual outputs (e.g. infographics or storyboards), and information sessions delivered in collaboration with community Steering Group members.

Work package 3: Co-design with service providers for strengthening local capacity.

Background Current service delivery to address sleep health for First Nations peoples' needs to provide culturally responsive care [3]. Evidence from our pilot work suggests that many healthcare providers need more resources, training, and information to address First Nations peoples' cultural and contextual needs effectively [13]. This lack of support limits their capacity to deliver clinically effective and culturally respectful care.

WP3 addresses these challenges using information gathered through community co-design workshops with clinicians and service providers. These workshops will integrate healthcare providers' needs and perspectives with the cultural needs of First Nations patients (informed by WP2). By collaboratively identifying and addressing these gaps, this WP aims to co-design a training framework that equips clinicians with resources and/or tools while enhancing the knowledge needed for culturally responsive sleep health service delivery.

Participants This WP will aim to recruit ~100 service providers involved in sleep health service delivery to participate in the co-design process. The following inclusion criteria will be applied: (1) consenting adults ≥18 years, (2) written and/or verbal consent provided and (3) experience in supporting First Nations peoples with sleep health issues. Eligible participants will be clinical staff (e.g. respiratory consultants, sleep scientists, psychologists, general practitioners, allied health clinicians, nurses, AHWs/Aboriginal Health Practitioners) from participating organizations and related services (e.g. respiratory and sleep clinics, SEWB services, and general practice clinics) and non-clinical staff (e.g. administration team, clinic managers).

Methodological approach Clinical and non-clinical staff from participating organizations and other non-metropolitan healthcare services will be invited to join virtual/face-to-face co-design workshops.

These workshops are designed to:

- Understand the challenges experienced by sleep health service providers in providing culturally responsive care for the sleep health needs of First Nations people.
- Generate an evidence-based, co-designed sleep health training package, resources, and factsheets in partnership with service providers and in consultation with local communities.
- Develop an implementation framework to support the partner organizations in integrating the training package into organizational Learning Management Systems.

The co-design workshops will be conducted in the following phases: The Learning phase (workshops 1 and 2) will include interactive methods, such as service scenarios and service and system mapping, to understand service providers' capacity building needs and service/system gaps and develop frameworks for evidence-based and culturally responsive OSA service delivery.

In the Designing phase (workshop 3), the participants will co-develop resources for delivering culturally responsive care. Drawing on a synthesis of outcomes from the earlier workshop findings (workshops 1 and 2), guided by community-identified needs (WP2), the learning resources will be informed by robust evidence (WP1), standard clinical guidelines [7,], and narrative therapy approaches [31].

This WP will also develop service delivery frameworks to integrate and sustain culturally responsive OSA care at participating healthcare services. The Refining phase (workshop 4) will elicit participants' feedback to refine the frameworks and resources. Data collection tools will be utilized at various timepoints throughout the WP to gather crucial knowledge from both a workshop facilitator and participant perspective. These data collection tools will be co-designed and approved by the Data Governance Committee before use. Workshop outputs will be presented to the Community Steering Group to assess their relevance and appropriateness and ensure the co-design outputs are responsive to the needs and perspectives of First Nations peoples.

Data analysis Participants' demographic data analysis will allow us to assess the diversity of the participant groups and ensure that key stakeholders who would utilize the co-design products were part of the co-design process. Reflexive inductive thematic analysis approaches will be used for qualitative data. Initial analysis will involve independent coding by two research team members, with a third First Nations research team member ensuring data integrity and appropriateness. Once the codes are developed and agreed upon, they will be checked by a fourth team member. Common themes will be generated based on data interpretation and analysis. The Service Providers' Advisory Committee will provide a final review and approval of the training package and other resources developed from the project.

Stage 2—implementation and evaluation (Work Package 4-5).

Work package 4: AHWs and nurses' capacity and capability building and evaluation. In rural and remote settings,

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specialist sleep services are often unavailable, necessitating travel to metropolitan areas to access care and posing significant logistical and financial challenges for patients and their families [32]. The availability of a locally available trained workforce can overcome some of the service access barriers and reduce sleep health inequities faced by First Nations peoples. AHWs, who often act as bridges between communities and health services, may also play an important role in supporting persons with OSA and their health providers. In some communities, nurses are the only practitioners available to residents, making their role indispensable. By focusing on both AHW and nurse training and capacity building and valuing their rich community, cultural, and clinical knowledge, a unique opportunity exists to offer locally led models of care. A nurse-led and AHW-supported OSA service has the potential to offer culturally responsive sleep healthcare and a clinically effective model of care that meets the needs of First Nations peoples.

This WP aims to design and implement a multifaceted training program for AHWs and nurses to build their skills and competencies in OSA screening, diagnosis, and management. This training will position AHWs to apply deep cultural knowledge and community linkages alongside nurses' clinical expertise to deliver culturally responsive and effective care.

Training framework and delivery The WP4 training package will be offered to AHWs, nurses, and community researchers to support them in delivering OSA education sessions in community settings, conducting OSA screening, and facilitating home-based sleep studies. Insights from WP2 and WP3 will inform key elements to ensure the training is culturally relevant, practical, and aligned with community needs.

Sleep scientists and clinicians will deliver the training through university-based learning management (∼50 h) and practical sessions (∼20 h split over an initial and follow-up session), including tutorials and refresher sessions if required and available. The training of AHWs will build on previously trialed “Sleep Coach” training [11, 33] and cover general sleep education and physiology modules, OSA risk factors, screening, patient set up for home sleep studies, and patient/carer education and support. Nurses' training will focus on the pathophysiology of sleep and OSA, OSA diagnosis, sleep study interpretation, treatment options and plans, treatment adherence, continuous positive airway pressure (CPAP) therapy, referral pathways, and patient/carer education and support (informed from WP3 and developed before commencement of WP5). Since patients with OSA also experience insomnia [34], the training will also cover information on insomnia management to support patients seeking care for insomnia management. Each module will include standardized competency assessments. To ensure the OSA service is culturally responsive, AHWs, and nurses will also receive training on narrative therapy, which will help with effective patient/carer engagement with care, culturally responsive service delivery—creating space for patients/carers to share their stories, discuss the impact of sleep health on their lives, and build motivation for engaging with OSA care. First Nations cultural mentors will provide ongoing mentoring to align clinical service delivery with First Nations ways of knowing, being, and doing, this will also be provided to the facilitators. Post-training, all participants will be invited to attend follow-up monthly sessions to discuss case studies and clinical scenarios, enabling a community of practice and collaboration among non-metropolitan service providers.

Training evaluation Participants will be invited to join virtual focus group sessions to share their perceptions of training effectiveness, accessibility, and usability (online training), structural barriers and enablers affecting training uptake, and suggestions for improvement.

WORK PACKAGE 5: OSA SERVICE DELIVERY AND EVALUATION.

Background Leveraging the support of trained AHWs and nurses, the final stage of the LYAS-OSA program will develop a model incorporating an implementation framework and processes at two participating sites. A local model for OSA service delivery will be implemented in Mount Isa and Cairns, and its clinical and cultural effectiveness will be evaluated. Findings from this WP will provide key insights into the model's effectiveness, sustainability, and scalability and identify barriers and areas for refinement.

Hypothesis

1) This WP will demonstrate the rate of polysomnographic-confirmed OSA in participants who are considered high risk for OSA on screening measures (exploratory hypothesis).
2) In those diagnosed with OSA who progress to the treatment phase, compared to baseline (pre), there will be a significant improvement in OSA outcomes (measured using decrease in daytime symptoms and quality of life at follow-up (1 and 3 months).

Measures We will use the following measures for this WP:

1) *OSA-50*: The OSA-50 [35] is a screener for Obstructive Sleep Apnea in the primary care setting, validated on level 1 (full laboratory) PSG and the level 3 ApneaLink PSG devices that will be used in this study. The OSA-50 has high sensitivity (0.96–0.97) and specificity (0.87–0.82) in detecting and excluding cases of OSA in the home sleep study setting.
2) *Functional Outcomes of Sleep Questionnaire (Short Version) (FOSQ-10)*: The FOSQ-10 [36] is a short form version of the Functional Outcomes of Sleep Questionnaire. The tool measures the impact on activities of daily living attributable to daytime sleepiness. The FOSQ-10 is highly correlated with the long form FOSQ, with a lower question burden (66 per cent fewer questions), and has been demonstrated to distinguish healthy controls from subjects with OSA.
3) *EQ-5D-5L:* The EQ-5D-5L [37] is a general measure of health and its economic value. The tool measures the presence of five health domains: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression and has been validated and used extensively in research and policymaking worldwide.
4) General Practice Sleep Scale (GPSS): The GPSS [38] is a recently developed screener for OSA in primary care settings, validated against the frequently used screeners in Australia. Unlike many OSA screeners which satisfy Australian Medicare criteria, the GPSS was validated in the Northern Territory, Australia, on a sample which included First Nations Australians.

Patient recruitment Trained AHWs will run community sessions to improve community understanding of OSA, promote OSA services, and encourage people at risk of OSA to seek care.

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The AHW will screen patients 18–75 years, presenting to the clinic with suspected OSA using the Medicare criteria (OSA-50 score > 5, ESS > 8) [34]. Patients meeting the inclusion criteria and able to provide informed consent will be invited to participate in screening and home PSG (where screeners are positive). The inclusion/exclusion criteria are based on current Medicare guidelines and aim to recruit patients who can be safely managed in the community setting [39] in screening and home PSG (where screeners are positive).

OSA DIAGNOSIS AND MANAGEMENT. Patients meeting the criteria for a home-based sleep study will be visited by trained AHWs to conduct diagnostic and follow-up sleep studies. Using the standard guidelines, qualified sleep technicians will score valid overnight sleep studies, where there is a minimum usable and analyzable recording time (i.e. free of gross signal loss or artifact preventing interpretation) of 5 h [40] to categorize OSA as mild, moderate, or severe [41]. Persons with mild OSA will be offered education and support to manage OSA symptoms. Our approach involves trained AHWs who will provide culturally responsive education to community members about the role of modifiable factors, such as alcohol in OSA. By engaging trusted local health workers, we aim to ensure that information about alcohol use and its effects on sleep health is delivered in a culturally safe and relevant way, fostering greater understanding and acceptance of this information within the community. Moderate–severe OSA will be managed locally, with suspected complex/atypical cases referred to specialist services (e.g. severe and prolonged oxygen desaturations demonstrated on PSG). Trained nurses (from WP4) will lead patient management and support using a person-centric approach and best practice guidelines. Patient management will include a combination of CPAP modifiable factors, e.g. weight management, smoking cessation, and sleep hygiene. The trained nurses and AHWs will offer personalized education to patients (and their carers) on CPAP devices and conduct regular follow-ups at 2 weeks, 1 month, and 3 months to optimize participant experience and compliance. Level 2 PSG and CPAP devices will be retained by the partner organizations in Mount Isa and Cairns to enable continuity of services and care upon conclusion of the project. Sleep physicians contracted by the research team will provide expert guidance for effective patient management.

Service evaluation The evaluation framework will be guided by developmental evaluation approaches and the Ngaa-bi-nya framework (First Nations' health program evaluation) [30, 42] and integrate co-designed success indicators (WP2), enabling repeated feedback reflection and adaptation as service delivery unfolds. At baseline, AHWs will collect data on the patient's sociodemographics, lifestyle, anthropometrics, and comorbidities. Patients will be followed up at 1 and 3 months to assess changes in key clinical and functional indicators: Functional Outcomes of Sleep Questionnaire Short Form [36], vitality and mental health (Short Form 36) [43], insomnia (Insomnia Severity Index) [44], CPAP adherence (≥4 h a night for ≥70 per cent of nights) [45], blood pressure, and weight. Service acceptability and context-specific factors affecting the service (e.g. patient and provider experiences, logistical challenges, and opportunities to improve and sustain the service) will be assessed through document review, stakeholder interviews, and yarning circles.

Sample size and data analysis Accounting for 30 per cent attrition, the recruitment of 258 participants across four sites (intra-class correlation coefficient 0.1) will be adequate to offer 80 per cent power for detecting clinically meaningful changes (pre vs. post) in daytime sleepiness, and OSA severity and impact (Cohen's $d = 0.6$) [9]. Multilevel modeling and latent class analysis will be used for quantitative data collected through interviews and yarning circles, and reflexive inductive thematic analysis approaches will be used for qualitative data [46]. First Nations researchers will help interpret the results through a lens of cultural competence and ensure strengths-based reporting [30].

Discussion

This study protocol presents the rationale and methods for the LYAS-OSA research program. It describes the approach to co-designing, implementing, and evaluating a culturally responsive, nurse-led, AHW-supported local, primary care delivered OSA diagnosis, and management model of care, which will be implemented in 12 First Nations communities in Queensland, Australia. LYAS-OSA aims to address barriers, including geographic isolation and lack of cultural appropriateness, to timely and appropriate OSA care for First Nations Australians. It also addresses barriers to seeking care identified by community members, including limited awareness and shame.

The research program will culminate with an evaluation of the co-designed service model for local delivery of culturally responsive OSA care in First Nations communities. This program evaluation component will identify the aspects of the service model that work well for First Nations participants, using indicators of success that were co-defined by that community. The evaluation will determine the model's feasibility and acceptability, identify areas for improvement and future modification, and contribute to the evidence base for best practice diagnosis and management of OSA for non-metropolitan First Nations Australian adults. Furthermore, the evidence generated through the enabling WPs, including the advanced data analytics, AHWs and nurse training packages, education resources, and LYAS-OSA model framework, may have broader practical and clinical utility. Program outcomes will be disseminated through our knowledge mobilization group to engage a broad range of policy, advocacy, and practice stakeholders to maximize the reach of the program's findings.

This program also has strong partner support, with nine partner organizations involved, including public HHS', Aboriginal Community Controlled Health Organizations, and First Nations health and well-being services and advocacy groups. This partnership support will enable engagement with health professionals in the co-design workshops and capability-building activities and provide opportunities to understand the challenges in adopting best practices and develop appropriate solutions. Partnerships with healthcare providers also enable capacity and capability for translational research and facilitate rapid uptake of research findings/outcomes in informing clinical service delivery. Most importantly, the LYAS-OSA program has strong community support. In previous foundational work [11], extensive consultation with key stakeholders developed a community-wide vision for improving First Nations' sleep health. LYAS-OSA extends this work to achieve sustainable improvements in OSA care in First Nations communities, prioritizing genuine engagement and co-design with consumers and health providers.

The limitations of this research include that the service model evaluation will not be conducted using a randomized control trial design. Without a control group, comparisons can only be made pre-to post-implementation of the model of care. Additionally, the generalizability of findings may be limited to the communities in

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which the program was co-designed. Nonetheless, the LYAS-OSA framework and resources may help improve OSA diagnosis and management in primary care services. It is, however, important to acknowledge the importance of meaningfully engaging and co-designing interventions with local communities, adopting a place-based approach, because what works for one community may not necessarily be needed or appropriate for other communities. Furthermore, while this project will implement a model of care for local OSA testing and treatment with CPAP, the funding landscape of the Australian healthcare system is such that affordable access to CPAP is scarce. By ensuring CPAP machines and accessories are owned by the project's partner organizations, it is hoped that this will enable ongoing care for some in the community following the research project's conclusion. In the state of Queensland, where the model of care will be implemented, there is a publicly funded scheme (Queensland Health Sleep Disorders Program) to loan CPAP devices to low-income patients following demonstrated compliance in using a rental machine at the patient's own cost [47]. It is conceivable that, in the future, the partner organizations could utilize the CPAP equipment purchased through the project to demonstrate a patient's treatment compliance to satisfy eligibility for loaning equipment long-term through the public health system. An additional limitation of the model is the decision to implement CPAP as the only treatment option. Whilst mandibular advancement splints (MAS) and other non-ventilatory treatments (e.g. electronic positional devices) can be effective and preferred by some with OSA, they are, generally, less effective than CPAP and would be an unfeasible additional cost within research budget constraints. This is particularly relevant when considering that MAS devices ideally require customization to a specific patient's orofacial anatomy, and then cannot be used by another participant in the study (unlike a CPAP machine).

This program is expected to contribute to capacity and capability building for AHWs and Nurses, who will benefit from theoretical and practical training on OSA diagnosis and management, informed by a co-design process involving consumers and healthcare professionals. This research program can also enable future clinical trials related to OSA diagnosis and care in First Nations communities.

Study findings, including evaluation findings, will advance knowledge about delivering culturally responsive OSA services for First Nations Australians. As such, LYAS-OSA will improve sleep health equity for First Nations Australians, particularly those living in non-metropolitan areas who experience barriers to accessing inclusive services and systems that identify and manage sleep disorders and overall health status.

Supplementary material

Supplementary material is available at *SLEEP Advances* online.

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Author contributions

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Data availability

There is no data associated with this protocol paper.

Ethics

Aspects of this work have received approval: Research for Work Package 1 has received approval from the Townsville Hospital and Health Service HREC: HREC/QTHS/95437. Research for Work

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Packages 2 and 3 has received approval from University of Queensland HREC (2023/HE001851, 2023/HE000624).

Abbreviations

ACCHO: Aboriginal Community Controlled Health Organizations
HHS: Hospital and Health Services
LYAS-OSA: Let's Yarn About Sleep-Obstructive Sleep Apnea Program
MAS: mandibular advancement splint
WP: work package

References

1. Blunden S, Fatima Y, Yiallourou S. Sleep health in indigenous Australians: a review on the state of Indigenous Sleep Health in Australia. Indigenous sleep health working party: the Australasian Sleep Association 2020, sleep health in Indigenous Australian children: a systematic review. *Sleep Medicine* 2021;**80**: 305–314. https://doi.org/10.1016/j.sleep.2021.01.065
2. Blunden S, Yiallourou S, Fatima Y, Australasian Sleep Association Indigenous Sleep Health Working Party. Sleep health and its implications in First Nation Australians: a systematic review. *Lancet Reg Health West. Pac.* 2022;**21**:100386. https://doi.org/10.1016/j.lanwpc.2022.100386
3. Fatima Y, King S, Solomon S, Bucks R, Skinner T. P037 indigenous Australians' conceptualisation of sleep health differs from western interpretations. *Sleep Adv.* 2021;**2**(Suppl. 1):A33. https://doi.org/10.1093/sleepadvances/zpab014.085
4. Woods CE, McPherson K, Tikoft E, *et al.* Sleep disorders in Aboriginal and Torres Strait Islander people and residents of regional and remote Australia. *J Clin Sleep Med.* 2015;**11**(11):1263–1271. https://doi.org/10.5664/jcsm.5182
5. Woods CE, Usher K, Maguire GP. Obstructive sleep apnoea in adult indigenous populations in high-income countries: an integrative review. *Sleep Breathing.* 2015;**19**(1):45–53. https://doi.org/10.1007/s11325-014-1032-7
6. Flemons WW, Douglas NJ, Kuna ST, Rodenstein DO, Wheatley J. Access to diagnosis and treatment of patients with suspected sleep apnea. *Am J Respir Crit Care Med.* 2004;**169**(6):668–672. https://doi.org/10.1164/rccm.200308-1124PP
7. Douglas JA, Chai-Coetzer CL, McEvoy D, *et al.* Guidelines for sleep studies in adults-a position statement of the Australasian Sleep Association. *Sleep Med.* 2017;**36**(Suppl 1):S2–S22. https://doi.org/10.1016/j.sleep.2017.03.019
8. Hamilton G, Joosten S. Sleep disorders in indigenous communities: time to close the gap. *J Clin Sleep Med.* 2015;**11**(11):1255–1256. https://doi.org/10.5664/jcsm.5178
9. Chai-Coetzer CL, Antic NA, Rowland LS, *et al.* Primary care vs specialist sleep center management of obstructive sleep apnea and daytime sleepiness and quality of life: a randomized trial. *JAMA.* 2013;**309**(10):997–1004. https://doi.org/10.1001/jama.2013.1823
10. Smith K, Fatima Y, Knight S. Are primary healthcare services culturally appropriate for Aboriginal people? Findings from a remote community. *Aust J Prim Health.* 2017;**23**(3):236–242. https://doi.org/10.1071/PY16110
11. Fatima Y, Von Senden R, Bucks RS, *et al.* A co-designed program for better sleep in Australian First Nations adolescents: protocol for the let's yarn about sleep adolescent sleep health program. *Sleep Adv.* 2025;**6**(2). https://doi.org/10.1093/sleepadvances/zpaf012
12. *Department of Health National Aboriginal and Torres Strait Islander Health Plan 2021–2031*. Canberra Commonwealth of Australia; 2021. Canberra, ACT, Australia.
13. Ashby C, Kinghorn M, Von Senden R, *et al.* P070 cultural determinants of sleep health for First Nations adolescents: perspectives of service providers in remote communities. *Sleep Adv.* 2024;**5**(Suppl. 1):A50. https://doi.org/10.1093/sleepadvances/zpae070.152
14. Queensland PW. *Nukal Murra Social and Emotional Wellbeing Framework Commonwealth of Australia*. 2018. Published by Western Queensland PHN, Mount Isa, QLD.
15. Carroll S, *et al.* The CARE Principles for Indigenous Data Governance. *Data Sci J.* 2020;**19**:1–12. https://doi.org/10.5334/dsj-2020-042
16. NHMRC. *Ethical Conduct in Research with Aboriginal and Torres Strait Islander Peoples and Communities: Guidelines for Researchers and Stakeholders*. Canberra: National Health and Medical Research Council; 2018.
17. Malhotra A, Mesarwi O, Pepin J-L, Owens RL. Endotypes and phenotypes in obstructive sleep apnea. *Curr Opin Pulm Med.* 2020;**26**(6):609–614. https://doi.org/10.1097/MCP.0000000000000724
18. Liu Y, Ghafoor AA, Hajipour M, Ayas N. Role of precision medicine in obstructive sleep apnoea. *BMJ Med.* 2023;**2**(1): e000218. https://doi.org/10.1136/bmjmed-2022-000218
19. Azarbarzin A, Sands SA, Stone KL, *et al.* The hypoxic burden of sleep apnoea predicts cardiovascular disease-related mortality: the Osteoporotic Fractures in Men Study and the Sleep Heart Health Study. *Eur Heart J.* 2019;**40**(14):1149–1157. https://doi.org/10.1093/eurheartj/ehy624
20. Eckert DJ, White DP, Jordan AS, Malhotra A, Wellman A. Defining phenotypic causes of obstructive sleep apnea. Identification of novel therapeutic targets. *Am J Respir Crit Care Med.* 2013;**188**(8): 996–1004. https://doi.org/10.1164/rccm.201303-0448OC
21. Edwards BA, Eckert DJ, McSharry DG, *et al.* Clinical predictors of the respiratory arousal threshold in patients with obstructive sleep apnea. *Am J Respir Crit Care Med.* 2014;**190**(11):1293–1300. https://doi.org/10.1164/rccm.201404-0718OC
22. Sands SA, Edwards BA, Terrill PI, *et al.* Phenotyping pharyngeal pathophysiology using polysomnography in patients with obstructive sleep apnea. *Am J Respir Crit Care Med.* 2018;**197**(9):1187–1197. https://doi.org/10.1164/rccm.201707-1435OC
23. Sands SA, Terrill PI, Edwards BA, *et al.* Quantifying the arousal threshold using polysomnography in obstructive sleep apnea. *Sleep.* 2018;**41**(1). https://doi.org/10.1093/sleep/zsx183
24. Terrill P, Edwards BA, Nemati S, *et al.* Quantifying Ventilatory Control Contribution to Sleep Apnoea Using Polysomnography Online Supplement. *Eur Respir J.* 2015;**45**(2):408–418. https://doi.org/10.1183/09031936.00062914
25. *Australian Government Bedtime Reading: Inquiry into Sleep Health Awareness Australia*. Canberra Australian Government; 2023, Canberra, ACT, Australia.
26. Jull J, Giles A, Graham ID. Community-based participatory research and integrated knowledge translation: advancing the co-creation of knowledge. *Implementation Sci.* 2017;**12**(1):1–9. https://doi.org/10.1186/s13012-017-0696-3
27. Dudgeon P, Bray A, D'Costa B, Walker R. Decolonising psychology: validating social and emotional wellbeing. *Aust Psychol.* 2017;**52**(4):316–325. https://doi.org/10.1111/ap.12294
28. Woodroffe T. Indigeneity-a skill-set for teaching. *J Aust Indigenous Issues.* 2016;**19**(1-2):117–131. https://doi.org/10.3316/informit.200155395882036

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29. Borunda R, Murray A. The wisdom and science behind indigenous cultural practices. In: Amy M, Rose B, eds. *Disrupting Racism in US Schools Transcending the (Un)Civil War*. United States: Springer; 2024:77–96. https://doi.org/10.1007/978-3-031-49562-5_5
30. Williams M. Ngaa-bi-nya Aboriginal and Torres Strait Islander program evaluation framework. *Eval J Aust*. 2018;**18**(1):6–20. https://doi.org/10.1177/1035719X18760141
31. Borunda R, Murray A. The wisdom of and science behind indigenous cultural practices. *Genealogy*. 2019;**3**(1):6. https://doi.org/10.3390/genealogy3010006
32. Booker LA, Hodge B, Skinner TC. Rethinking the distribution of sleep services: discrepancy of obstructive sleep apnoea in rural compared with metropolitan men in Australia—a large national survey. *Rural Remote Health*. 2023;**23**(3):1–7. https://doi.org/10.22605/RRH7704
33. Jabran S, Smith S, Fatima Y, King S. Sleep health promotion in aboriginal and Torres Strait Islander communities: untapped potential of indigenous youth workers as sleep coaches. *Sleep Adv*. 2021;**2**(Suppl. 1):A4. https://doi.org/10.1093/sleepadvances/zpab014.006
34. Medicare Benefits Schedule Review Taskforce. *Final Report from the Thoracic Medicine Clinical Committee. Secondary Final Report from the Thoracic Medicine Clinical Committee*. 2016. Published by Australian Government Department of Health and Aged Care, Canberra, ACT, Australia.
35. Chai-Coetzer CL, Antic NA, Rowland LS, *et al*. A simplified model of screening questionnaire and home monitoring for obstructive sleep apnoea in primary care. *Thorax*. 2011;**66**(3):213–219. https://doi.org/10.1136/thx.2010.152801
36. Chasens ER, Ratcliffe SJ, Weaver TE. Development of the FOSQ-10: a short version of the functional outcomes of sleep questionnaire. *Sleep*. 2009;**32**(7):915–919. https://doi.org/10.1093/sleep/32.7.915
37. Herdman M, Gudex C, Lloyd A, *et al*. Development and preliminary testing of the new five-level version of EQ-5D (EQ-5D-5L). *Qual Life Res*. 2011;**20**(10):1727–1736. https://doi.org/10.1007/s11136-011-9903-x
38. Howarth T, Hedger J, Chen W, Garg H, Heraganahally SS. General practice sleep scale—the "GPSS"—a proposed new tool for use in general practice for risk assessment of obstructive sleep apnoea. *Sleep Med*. 2025;**125**:168–176. https://doi.org/10.1016/j.sleep.2024.11.022
39. Rosen IM, Kirsch DB, Carden KA, *et al*. Clinical use of a home sleep Apnea test: an updated American Academy of Sleep Medicine Position Statement. *J Clin Sleep Med*. 2018;**14**(12):2075–2077. https://doi.org/10.5664/jcsm.7540
40. Wittine LM, Olson EJ, Morgenthaler TI. Effect of recording duration on the diagnostic accuracy of out-of-center sleep testing for obstructive sleep apnea. *Sleep*. 2014;**37**(5):969–975. https://doi.org/10.5665/sleep.3672
41. American Academy of Sleep Medicine Task Force. Sleep-related breathing disorders in adults: recommendations for syndrome definition and measurement techniques in clinical research. The report of an American Academy of Sleep Medicine Task Force. *Sleep*. 1999;**22**(5):667–689[Published Online First: August 18, 1999]. https://doi.org/10.1093/sleep/22.5.667
42. Togni S, Askew D, Rogers L, *et al*. Creating safety to explore: strengthening innovation in an Australian Indigenous primary health care setting through developmental evaluation. In: Michael Quinn Patton, Kate McKegg, Nan Wehipeihana eds. *Developmental Evaluation Exemplars Principles in Practice*. New York, United States: Guilford Press; 2015:234–251.
43. Weaver TE, Laizner AM, Evans LK, *et al*. An instrument to measure functional status outcomes for disorders of excessive sleepiness. *Sleep*. 1997;**20**(10):835–843. https://doi.org/10.1093/sleep/20.10.835
44. Goudge R, Goh N, Barnes M, Howard M, Worsnop C. Validation of a sleep apnoea symptom questionnaire. *Am J Respir Crit Care Med*. 2001;**163**(5):A933.
45. Kribbs NB, Pack AI, Kline LR, *et al*. Objective measurement of patterns of nasal CPAP use by patients with obstructive sleep apnea. *Am Rev Respir Dis*. 1993;**147**(4):887–895. https://doi.org/10.1164/ajrccm/147.4.887
46. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol*. 2006;**3**(2):77–101. https://doi.org/10.1191/1478088706qp063oa
47. State. *Queensland Health Sleep Disorders Program: Information for Clinicians*. Brisbane, Queensland: Queensland Health; 2024.

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